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miles in length to three; and Lake Abyshkan, in the early part of the century forty miles from north to south and seventeen from east to west, is reduced to three small ponds, the largest scarcely a mile and a half wide. Another lake, Tchebakly, which in 1784 was forty miles by thirty, is also now reduced to three ponds, the largest less than two miles across.

Among the results of the New Zealand earthquake are the addition of 300 feet to the height of Mount Tarawera, and the subsidence of the beautiful Lake Rotomahana, which is transformed into an expanse of seething mud. Its renowned terraces are reported to be destroyed. Large areas are covered with volcanic dust and mud. Lake Rotomahana was the wonderland of the volcanic belt of the North island, as it was surrounded with terraces of silica from which issued hot springs and geysers.

The Transcaspian railway was, on the 14th day of July, opened for traffic as far as Merv. The entire length of the line to Samarcand will be 1335 versts, or 890 miles. Three hundred versts of this is in Bokharan territory. Between Michailovsk, on the Caspian, and Samarcand, there are in all sixty-three stations, several of which have to be supplied with water by pipe-lines or water-trains, while others are provided with artesian wells.

Mr. H. O. Forbes has returned to New South Wales. He was unable to ascend the Owen Stanley range, but reached a point sixty-five miles from Port Moresby.

GEOLOGY AND PALÆONTOLOGY.

A Remarkable Extinct Geyser Basin in S. W. Colorado.[1]—In many features the Yellowstone National Park region is closely paralleled by several other districts. In its geography, and to a large degree in its geognosy, it does not materially differ from a portion of the country adjacent to the elevated "pinnacle," which parts the waters of the Rio Grande, the Arkansas and the Colorado. As early as 1879, my own familiarity with the former area led me to the detection of traces in Southern Colorado of the same action which has marked the later stages of volcanic decadence in the park. Afterwards, from month to month, evidences of this nature multiplied from further researches, until in 1882 it was safe to announce that a considerable portion of the San Juan mining region is covered by the deposits from ancient thermal springs.[2] At this time the peculiar *bonanzas* of the Red Mountain district began to receive attention, and the predictions of the writer, based upon the foregoing conclusions, were invariably verified in the exploitation of the mines. But the development of the ore-bodies and much more detailed examination of the area in question, revealed other and more interesting facts concerning the growth of the lodes in this restricted area. It soon became evident that the extremely peculiar topography of the country at the head of Red creek, in Ouray county, could have been produced only by the accumulative action of numerous enormous geysers, far more effective than those to-day at work in the Yellowstone Park, though occupying, perhaps, a less extensive basin. Probably, however, not a little of the area over which the hot spring deposits can be traced, may have been the seat of important geysers. In fact, there are reasons for making this statement more definite, but it will be best to confine ourselves to what can be clearly described in a few words, without consideration of nice structural details.

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[1] Read before Section E., A. A. A. S., Buffalo Meeting, 1886.

[2] Notes on the geology and mineralogy of San Juan county, Colorado, by Theo. B. Comstock. Published in Trans. American Institute of Mining Engineers, Vol. XI, pp. 165–191 (*with map*).

The upper valley of Red creek is thickly studded with mounds of varying size, but not widely different in form. All these are more or less closely connected with the present (or comparatively recent) local drainage, which is also bounded at irregular intervals by dry pits and pools of cold water quite similar to the bowls of existing hot springs in other localities. The remarkable characteristics of this basin are the number and the magnitude of the mounds and the total absence of active thermal springs, notwithstanding the existence of such in localities not far distant, as at Ouray. The altitude of the district is from about 9500 feet to 12,000 feet, whereas few, if any, of the present hot water bowls are known above 6500 feet, hereabouts.

The cañon of Red creek is undoubtedly not one wholly of aqueous erosion, but the drainage has been induced in part by seismic action, modified in an interesting manner by glacial scorings and subsequent diluvial deposition. The Red Mountain geyser area, as we may designate this tract, is now topographically restricted, as here indicated, almost wholly to the upper portion of this interesting cañon, but it may be really separated into three well-marked basins, which formerly fed as many separate affluents of the main stream. Two of these are proven to be metalliferous, while the third is almost unexplored, though giving indications of similar character, but less promising perhaps.

The geyser areas do not seem to extend beyond the region of maximum intensity of the volcanic action in the rhyolytic period, and the ore-bodies all furnish evidence of secondary reactions taking place in the line of a prominent fault-fissure of that age. All along this course over a considerable breadth of territory, the remains of extinct thermal springs are (recognizably) most abundant, but the geyser character is not noticeable far towards the north or south of Red peak.

The transformations in the vein material, the aggregation of the ores into bonanzas (as at the Yankee Girl, Alaska and Old Lout mines, among others) with the very remarkable distribution of minerals in the lodes, are but a few of the intensely interesting details which can be there studied to the best advantage. Much that is there revealed has already thrown new light upon the origin and life-history of metalliferous deposits, but I cannot now touch upon these topics.[1] The gigantic geyser-mounds are in themselves of marked interest, not only from their great size and external configurations, but also on account of their internal structure as proven by the excavations made in some of them for mining purposes. The American Belle, Grand Prize and other mines were opened directly in mounds of this nature, and (as in many other cases where only ordinary thermal springs probably existed) caverns were invariably entered after passing through an outer shell of considerable thickness. In nearly all of these some connection with the surface was traceable by following the tracks of woodchucks, which had utilized the passages as domiciles. In the caverns, which are sometimes of large dimensions, there is usually a deposit of sulphuretted ores, with allied minerals, with a very considerable amount of yellow and red material resulting from its oxidation and the production of carbonates.

No doubt much valuable information bearing directly upon the life-history of the geyser may yet be gathered from detailed studies in this district. But little real exploration underground has yet been accomplished, and that small amount is but partially known to those who can make the best use of it for scientific purposes. All that the writer has yet observed agrees in most essentials with what may be seen in the extinct subterranean passages at Gardiner's river, Wyoming, except that the metalliferous deposits and the geyseritic relics are peculiar to the Red Mountain area.—*Dr. Theo. B. Comstock, Champaign, Illinois.*

SCHLOSSER ON CREODONTA AND PHENACODUS.[2]—Dr. Schlosser has attacked the problem of the Creodonta with his accustomed skill, and has thrown the additional light of his extensive acquaintance with mammalian anatomy on the subject. His opinion of the affinities of the group are as follows: He regards the Creodonta, with Cope, as a sub-order, but not like him, of an order Bunotheria, but rather with Lydekker, of the order Carnivora. He does not regard them as ancestral to the Carnivora, but as having had a common ancestor with that order. This common ancestor he derives from hypothetical Marsupialia with numerous temporary teeth. He excludes from the Creodonta the Hyænodontidæ and Miacidæ, regarding both as true Carnivora; the former on account of the supposed scapholunar bone reported by Gervais, the latter on account of the single flesh-tooth. He restricts the Creodonta to those forms which have two flesh-teeth, if any. From the Leptictidæ he excludes the genera Leptictis, Mesodectes, and Ictops, placing them in the Insectivora. He therefore changes the name Leptictidæ to Proviverridæ. Schlosser does not agree to the introduction to the Creodonta by Cope of the tritubercular families usually referred to the Insectivora, viz., the Talpidæ, Chrysochlorididæ, Centetidæ, Mythomyidæ. and Tupæidæ; but he does not give his reasons for this view.

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[1] The writer has announced these discoveries and given some of his own conclusions in a series of articles puplished in the Engineering and Mining Journal, 1882–84 inclusive, ("Distribution of San Juan county Ores"); in a further series in the same journal, 1884–86, now running ("Metallurgy of San Juan county Ores"); also in the paper previously quoted in Trans. Am. Inst. M. E., and at greater length in the same Transactions, May, 1886 ("Geology and Vein-Structure of S. W. Col," with four maps).

[2] Ueber das Verhaltniss der Cope'schen Creodonta zu den übrigen Fleischfressern; Morphologisches Jahrbuch 1886, p. 287, von Dr. Max. Schlosser.

The following remarks may be made on the above positions of Dr. Schlosser. The supposition that Hyænodon possesses a scapholunar bone has been shown by Professor Scott to be an error, so that this form must be retained in the Creodonta, to which it is connected by Pterodon. Specimens of Miacidæ in the Princeton Museum show that this family also possessed no scapholunar bone. This, together with the non-trochlear astragalus which I have described, shows that the Miacidæ must also be referred to the Creodonta. These points admitted, it becomes much easier to believe that the Carnivora are the descendents of Creodonta, through the Miacidæ. (The supposed connection between Oxyænidæ and Felidæ I denied in my last phylogeny in the article on Creodonta in the AMERICAN NATURALIST for 1884.) The exclusion of the three genera above named from the Leptictidæ, (Proviverridæ) has little significance, until the reasons for separating the Creodonta from the tritubercular Insectivora can be shown.

Dr. Schlosser's representation of my phylogenetic views is very inaccurate, owing to a misunderstanding of the dates of publication of my respective papers. The oldest of these is the Vol. III. Report U. S. Geol. Survey Terrs., sent to press in 1879, and not issued until February, 1885. The next in point of date are the illustrated papers on extinct Vertebrata, issued at various times in the AMERICAN NATURALIST. My latest phylogenetic opinions, delivered from fuller material and more mature reflection, were published in a paper on the " Evolution of the Vertebrata, Progressive and Retrogressive," in the February, March and April numbers of the AMERICAN NATURALIST for 1885. In the last of these papers the Lemuroidea are separated from the Bunotheria and placed in the Taxeopoda near the Condylarthra, to which they are allied. This does not include the Mesodonta (Pelycodus), which being unguiculate, remains with the Bunotheria. In the above paper all are derived from carnivorous Marsupialia, in accordance with the view of Hæckel's "Schöpfungsgeschichte."

Dr. Schlosser generously acknowledges, in another page, the prior indication of the ancestry of the Phenacodus and Hyracotherium of the horse line to his own, by Dr. J. L. Wortman in the

Revue Scientifique, Vol. xxxi, p. 705. But these relations had been previously pointed out by myself; that of Hyracotherium in the Palæontology of the Report of the Survey W. of the 100th meridian in 1877; and that of the Phenacodus in the Proceeds. Amer. Philos. Soc., 1881, p. 178.[1]—*E. D. Cope.*

DOLLO ON EXTINCT TORTOISES.[2]—The distinguished Belgian anatomist, M. Louis Dollo, has recently published two important papers on extinct tortoises from the Eocene formations of Belgium. The theme which gave rise to the first of these, is the description of a new genus and species of Chelydridæ, *Pseudotrionyx delheidi* Dollo. In preparing to do this, the author reviews the classification of the Testudinata in an extremely able manner. He adopts the system of Cope in the main, and in giving his reasons for doing so makes an important contribution to the subject. He differs in some details from the author of that system. Thus he separates Eurysternum from the Chelydridæ as type of a distinct family, because it possesses a fontanelle of the plastron; a character which the reviewer does not regard as of family value. He also unites the Propleuridæ with the Cheloniidæ, but as we shall see, he reëstablishes it as a sub-family in the second paper quoted, without apparently being aware of the fact.

M. Dollo somehow supposes that the author of the system he adopts regards the plastron of the Testudinata as homologous with the sternum of other Vertebrata, and also that the names he employs for the elements of the plastron are original with him. This is an error. The terms "postabdominal," etc., were introduced by the distinguished English anatomist, W. K. Parker, and the author criticised by M. Dollo, has stated in one of his papers, on which I cannot at this moment place my hand, that he adopts the views as to the homologies of the plastron, held by that authority. But M. Dollo thinks that the names Dactylosterna, Clidosterna and Lysosterna imply the erroneous homology with the sternum, and should therefore be charged. He then names these divisions Dactyloplastra, etc. Now names ought not to be changed without better reasons than those offered by M. Dollo, for the well-known *opprobrium scientiæ* is the multitude of names. Those in question were not given under an erroneous idea, but the word "sterna" was used figuratively, just as it is in many genera of the order. As well might M. Dollo change the generic names Eurysternum, Pleurosternum, etc., into Euryplastron, Pleuroplastron, etc. And this our author has not yet done.

The plates called intergular by me in Baëna appear to me to be homologous with the corresponding plates in Pleurodira, although

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[1] Also in NATURALIST for 1881, p. 1017.

[2] Premiére note sur les Cheloniens du Bruxellien de la Belgique; (Bull. Mus. Roy. Belgique 1886, p. 75). Premiér Note s. l. Cheloniens Landeniens de la Belgique; (l. c. 1886, p. 129).

M. Dollo thinks not and finds occasion for the creation of a new name. Adocus, another Cryptodire genus, has a single one well developed.

In his second article M. Dollo separates certain species referred by Professor Owen to the genus Chelonia, as representatives of another genus which he names Pachyrhynchus. It is characterized by the underroofing of the posterior nares, and by the great extent of the mandibular symphysis. He regards this character as requiring the creation of a sub-family of the Cheloniidæ, the Pachyrhynchinæ. The present writer has, however, described the same characters in two genera referred by him to the Propleuridæ (Euclastes and Lytoloma) and has referred to one of the European species (*Chelone planimentum* Owen—Pachyrhynchinæ Dollo) as presenting this character.[1] M. Dollo's genus is probably one of the American forms, and his Pachyrhynchinæ is the Propleuridæ Cope. M. Dollo's family characters are, however, better than those given by Cope.—*E. D. Cope.*

Geological News.—*General.*—M. Steinman recently gave to the Swiss Society of Natural Sciences an account of his explorations in the Southern Cordillera. The fossil fauna and flora are almost identical with those of European formations. The Upper Trias, Rhætian, Lias, Jurassic and Cretaceous are well represented.——Montpellier-le-Vieux, a city of eroded rocks, situated twelve kilometers from Millau, in the department of Aveyron, France, seems, according to a note of M. E. A. Martel, to be in some respects even more wonderful than the Garden of the Gods or Monument Park. A mass of rocks, sixty to eighty meters high, simulates an embattled donjon, and is called the citadel. Around this, five depressions, 100 to 124 meters deep, seem in one spot to form an amphitheater, in another a necropolis, in another part an open plaza, and again a city with narrow streets, obelisks, gates, etc., recalling Pompeii, Karnac or Persepolis. The whole is surrounded by a rocky wall exteriorly, 100 to 150 meters high; ravines passing through the talus of this simulate ditches, and outside of all this many groups of ruined rocks constitute a ceinture of detached forts.——J. Stirling has recently contributed to the Linnean Society of New South Wales a paper on further evidences of glaciation in the Australian Alps. The author and Dr. Lendenfeld found erratics, perched blocks, smoothed surfaces and old moraines upon Mount Bogong, the highest mountain in Victoria.

Silurian.—M. Hebert, who has for a considerable period been occupied with the study of the most ancient sedimentary rocks of the northwest of France, has come to the conclusion, that in Northern Brittany and Western Normandy the vertical slates (phyllades) of Saint Lo are at the base, while upon them lie the almost horizontal purple conglomerates, schists and red sandstones.——W. S. Ford (Amer. Jour. Sci. June, 1886) describes *Obolella desiderata* Billings, under the name of Billingsia, on account of peculiarities of the ventral valve which he considers generic.——A. M. Seely (Amer. Jour. Sci., July) describes three new species of sponges of the genus Strophochetus, and notes the distribution of the genus through the Middle Chazy.——Professor N. S. Shaler contributes to the same issue an account of the geology of Cobscook Bay district, Maine. The uppermost beds of the series contain fossils which he refers to the Devonian, possibly to the Ohio shale. Below these are beds which seem to belong to the Niagara and Clinton horizons, while the most numerous list of fossils seems to be of Lower Helderberg horizon. The series is less rich in organic forms than that of the St. Lawrence or of Central New York. The land area of this fiord region is principally occupied by intrusive volcanic rocks.

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[1] Transactions American Philosophical Society, 1870, pp. 146–8.

Tertiary.—M. Cotteau, in his last memoir upon fossil Echini, enumerates fifteen species of Brissopsis.——Mr. Clement Reid has recently studied the Pliocene deposits at Diest and Antwerp, after which he examined the deposit of ironstone at Lenham, England, the fossils in which were, in 1857, referred to the Pliocene by Professor Prestwich. The examination resulted in a thorough confirmation of Professor Prestwich's identification, which had been disputed. There is not a single Eocene species; with two or three exceptions all are known Pliocene forms, but many are represented by species now living in the Mediterranean. ——Dr. Otto Meyer contributes to the Amer. Jour. Sci., July, 1886, some observations on the Tertiary and Grand Gulf strata of Mississippi. His conclusions are (1) that in no place can Grand Gulf strata be seen in superposition over the marine Tertiary; (2) that there are two places where strata undistinguishable from Grand Gulf can be seen overlaid by marine Tertiary; (3) that the Grand Gulf formation is mainly not marine; (4) that a thick and extended marine green-sand formation with a Claibornian fauna, approaching the Jacksonian, is found in Eastern Mississippi.

Post-tertiary.—M. A. Gaudry recently exhibited to the Paris Academy of Sciences a reindeer's antler pierced with a large hole, and covered with well-executed carvings. One face shows two seals, a fish (salmon or trout) and three twigs of plants. One of the seals seems to be *P. vitulina.* On the other face are two eel-like slender animal figures, three indeterminable animals (alike) and an insect. This fragment of the reindeer age was discovered by M. Poignon in the Montgaudier caves, department of Chavente.——A valuable paper upon the post-Tertiary elevation of the Sierra Nevada, as shown by the river beds, has been contributed by Professor Jos. LeConte to the American Journal of Science. The cañons of California, cut far below the ancient river-beds, are correlated with the features of the plateau region to prove a great elevation which was permanent, while the drift and river deposits of the eastern region prove subsidence after Tertiary times.

BOTANY.[1]

HOW SHALL BOTANY BE TAUGHT IN AGRICULTURAL COLLEGES?—Numerous factors enter into the problem, such as the size of the class, the age and preparation of the students, the season of the year, the length of the college term, the probability of subsequent study, the means of illustrations which can be commanded and many other similar considerations. All of those factors are so different and so variously combined, that a method, which on the whole might be the best in some particular case, might not be the best in any other case whatever.

Roughly classified, we may make out three different methods of teaching botany now in vogue; these may be termed the text-book method, the lecture method and the laboratory method.

It is fashionable now-a-days to decry the text-book method as altogether out of date, but in the hands of a competent teacher a good text-book is a most valuable aid. The lecture method is necessary in very large classes, but satisfactory results are rarely reached, even with the aid of copious means of illustration and a fairly good work of reference in the hands of the student. Nor is the laboratory method, pure and simple, altogether free from objection. Left largely to himself to find out important facts in regard to the specimens he is given to study, the student is sure to go astray and waste much time, a loss needless and inexcusable.

A judicious combination of the methods named would in all probability secure the best results in a majority of cases.

Let me suppose the class to number from thirty to forty, composed of young men of average attainments and ability, and that from three to five hours per week for a year is to be given to the subject. A desirable time for beginning the work of instruction is at the opening of the winter term, which in most colleges is soon after New Year's. For the first term the object is to gain a general view of plants and plant-life. The basis of the instruction should be lectures or talks, occupying a part of the hour, which the teacher can vary according to the needs of the class. An excellent accompanying text-book is Bessey's Essentials of Botany, from which pages may be occasionally assigned as a lesson to be carefully learned. Every subject taken up should be copiously illustrated with specimens which the student is to see and examine for himself. Occasional days are to be set aside for careful reviews of subjects already studied, and from time to time opporunity should be afforded for the examination of specimens under the microscope.

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[1] Edited by Professor CHARLES E. BESSEY, Lincoln, Nebraska.